

WHAT IS CLAIMED:

1 1. A method for biological burden reduction, comprising a step of applying a
2 continuous stream of O_x to a material in a sealed biological burden reduction chamber,
3 wherein said O_x includes oxygen and its radicals.

1 2. The method of claim 1, wherein O_x is selected from an integer from 1 to 3.

1 3. The method of claim 1, further comprising continuously withdrawing O_x
2 from said sealed biological burden reduction chamber.

1 4. The method of claim 1, further comprising creating a pressure differential
2 within said biological burden reduction chamber and maintaining said pressure differential
3 while continuously applying said stream of O_x to said material.

1 5. The method of claim 4, further comprising agitating said O_x in said biological
2 burden reduction chamber to increase permeation of said O_x into said material.

1 6. The method of claim 5, wherein forced air is used to agitate said O_x.

1 7. The method of claim 5, wherein said agitating distributes said O_x evenly
2 throughout said biological burden reduction chamber.

1 8. The method of claim 5, further comprising

2 (a) creating a vacuum within said biological burden reduction chamber;

3 (b) generating O_x in an O_x generation cell;

4 (c) withdrawing a stream of O_x from said O_x generation cell into said
5 biological burden reduction chamber; and

6 (d) withdrawing O_x from said biological burden reduction chamber.

1 9. The method of claim 4, wherein said O_x generation cell comprises an O_x
2 generator capable of generating O_x at a pressure of less than 20 lbs/in² selected from one or

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1 more of the group consisting of corona discharge, high frequency electrical discharge,
2 ultraviolet light, x-ray, radioactive isotopes and electron beam.

1 10. The method of claim 8, wherein said O_x in said biological burden reduction
2 chamber is maintained at a concentration of about 0.1% to about 100% per total volume of
3 gases in said biological burden reduction chamber.

1 11. The method of claim 10, wherein O_3 in said biological burden reduction
2 chamber is maintained at a concentration of about 0.1% to about 25% per total weight of
3 gases in said biological burden reduction chamber.

1 12. The method of claim 11, wherein said O_3 in said biological burden reduction
2 chamber is maintained at a concentration of about 3% to about 16% per total weight of gases
3 in said biological burden reduction chamber, wherein an amount of O_3 used is dependent on
4 said material.

1 13. The method of claim 8, further comprising maintaining a pressure differential
2 between a pressure within said O_x generation chamber and a pressure within said biological
3 burden reduction chamber sufficient to continuously withdraw said O_x through said
4 biological burden reduction chamber.

1 14. The method of claim 8, further comprising using a biological burden
2 reduction chamber of about 100 ft.³ to about 8000 ft.³.

1 15. The method of claim 8, further comprising using a biological burden
2 reduction chamber of about 1 ft.³ to about 100 ft.³.

1 16. The method of claim 13, further comprising controlling water vapor present
2 in said continuous stream of O_x prior to applying said continuous stream of O_x to said
3 material.

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1 18. The method of claim 1, wherein said O_x is generated from ambient air or
2 components of ambient air.

1 19. The method of claim 1, wherein said O_x is generated from other oxygen
2 sources including gaseous oxygen, liquid oxygen, H_2O and mercuric oxide.

1 20. The method of claim 1, wherein the material is a food product.

1 21. The method of claim 1, wherein the material is a medical product.

1 22. The method of claim 1, wherein the material is a cosmetic ingredient.

1 23. The method of claim 1, wherein the material is a dietary supplement.

1 24. The method of claim 1, wherein the material is a botanical.

1 25. The method of claim 1, wherein the material is a nutraceutical.

1 26. The method of claim 1, wherein the material is a pharmaceutical ingredient.

1 27. The method of claim 1, wherein the material is a packaging material.

1 28. The method of claim 1, wherein the material is a nursery stock product.

1 29. The method of claim 1, wherein the material is a color additive.

1 30. The method of claim 1, wherein the material is a seed.

1 31. The method of claim 1, wherein the material is a personal care product.

1 32. The method of claim 1, wherein the material is an animal feed.

1 33. The method of claim 1, wherein the material is a flavoring.

1 34. An apparatus for biological burden reduction, comprising:

2 (a) a biological burden reduction chamber;

3 (b) a vacuum pump coupled to said biological burden reduction chamber;

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(d) a first control valve coupled to said biological burden reduction chamber and said 0_x generation cell, wherein said first control valve is capable of permitting said 0_x to be withdrawn from said 0_x generation cell into said biological burden reduction chamber; and

35. The apparatus of claim 34, further comprising a member for creating forced air contained within said biological burden reduction chamber, wherein said forced air distributes said O_x evenly throughout said biological burden reduction chamber.

1 37. The apparatus of claim 34, further comprising a means for controlling water
2 vapor coupled to said biological burden reduction chamber.

1 39. The method of claim 1, wherein said biological burden is selected from a
2 group of living entities including insects, bacteria, viruses, algae, yeasts, molds, nematodes,
3 parasites and weed seed.

1 40. The apparatus of claim 36, further comprising a means to convert said O_x to
2 O₂ prior to release into atmosphere.

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1 41. The method of claim 17, wherein a humidity of an atmosphere within said
2 biological burden reduction chamber is between about 20% to about 98%.

1 42. The method of claim 4, wherein a temperature within said biological burden
2 reduction chamber is between about 32°F and about 80°F.

1 43. The method of claim 1, wherein a flow rate of said continuous stream of O_x
2 within said biological burden reduction chamber is between about 0.1 L/min/ft³ and about 2
3 L/min/ft³.

1 44. The method of claim 1, further comprising applying a continuous stream of
2 one or more of a gas selected from the group consisting of N₂, CO₂ and Ar in addition to
3 said continuous stream of O_x.

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